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SEQUENCE LISTING

<110> Hanke, Paul D.

<120> Feedback-Resistant Pyruvate Carboxylase Gene from *Corynebacterium*

<130> 1533.1230001

<140> US 09/974,973

<141> 2001-10-12

<150> US 60/239,913

<151> 2000-10-13

B15
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<170> PatentIn version 3.0

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<211> 3474

<212> DNA

<213> *Corynebacterium glutamicum*

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<221> CDS

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cta gtg tcg act cac aca tct tca acg ctt cca gca ttc aaa aag atc 96
Leu Val Ser Thr His Thr Ser Ser Thr Leu Pro Ala Phe Lys Lys Ile
20 25 30

ttg gta gca aac cgc ggc gaa atc gcg gtc cgt gct ttc cgt gca gca	144
Leu Val Ala Asn Arg Gly Glu Ile Ala Val Arg Ala Phe Arg Ala Ala	
35 40 45	
ctc gaa acc ggt gca gcc acg gta gct att tac ccc cgt gaa gat cgg	192
Leu Glu Thr Gly Ala Ala Thr Val Ala Ile Tyr Pro Arg Glu Asp Arg	
50 55 60	
gga tca ttc cac cgc tct ttt gct tct gaa gct gtc cgc att ggt act	240
Gly Ser Phe His Arg Ser Phe Ala Ser Glu Ala Val Arg Ile Gly Thr	
65 70 75 80	
gaa ggc tca cca gtc aag gcg tac ctg gac atc gat gaa att atc ggt	288
Glu Gly Ser Pro Val Lys Ala Tyr Leu Asp Ile Asp Glu Ile Ile Gly	
85 90 95	
gca gct aaa aaa gtt aaa gca gat gct att tac ccg gga tat ggc ttc	336
Ala Ala Lys Lys Val Lys Ala Asp Ala Ile Tyr Pro Gly Tyr Gly Phe	
100 105 110	
ctg tct gaa aat gcc cag ctt gcc cgc gag tgc gcg gaa aac ggc att	384
Leu Ser Glu Asn Ala Gln Leu Ala Arg Glu Cys Ala Glu Asn Gly Ile	
115 120 125	
act ttt att ggc cca acc cca gag gtt ctt gat ctc acc ggt gat aag	432
Thr Phe Ile Gly Pro Thr Pro Glu Val Leu Asp Leu Thr Gly Asp Lys	
130 135 140	
tct cgt gcg gta acc gcc gcg aag aag gct ggt ctg cca gtt ttg gcg	480
Ser Arg Ala Val Thr Ala Ala Lys Lys Ala Gly Leu Pro Val Leu Ala	
145 150 155 160	
gaa tcc acc ccg agc aaa aac atc gat gac atc gtt aaa agc gct gaa	528
Glu Ser Thr Pro Ser Lys Asn Ile Asp Asp Ile Val Lys Ser Ala Glu	
165 170 175	
ggc cag act tac ccc atc ttt gta aag gca gtt gcc ggt ggt ggc gga	576
Gly Gln Thr Tyr Pro Ile Phe Val Lys Ala Val Ala Gly Gly Gly	
180 185 190	
cgc ggt atg cgc ttt gtt tct tca cct gat gag ctc cgc aaa ttg gca	624
Arg Gly Met Arg Phe Val Ser Ser Pro Asp Glu Leu Arg Lys Leu Ala	
195 200 205	
aca gaa gca tct cgt gaa gct gaa gcg gca ttc ggc gac ggt tcg gta	672
Thr Glu Ala Ser Arg Glu Ala Ala Phe Gly Asp Gly Ser Val	
210 215 220	
tat gtc gaa cgt gct gtg att aac ccc cag cac att gaa gtg cag atc	720
Tyr Val Glu Arg Ala Val Ile Asn Pro Gln His Ile Glu Val Gln Ile	
225 230 235 240	
ctt ggc gat cgc act gga gaa gtt gta cac ctt tat gaa cgt gac tgc	768
Leu Gly Asp Arg Thr Gly Glu Val Val His Leu Tyr Glu Arg Asp Cys	
245 250 255	
tca ctg cag cgt cgt cac caa aaa gtt gtc gaa att gcg cca gca cag	816
Ser Leu Gln Arg Arg His Gln Lys Val Val Glu Ile Ala Pro Ala Gln	
260 265 270	
cat ttg gat cca gaa ctg cgt gat cgc att tgt gcg gat gca gta aag	864
His Leu Asp Pro Glu Leu Arg Asp Arg Ile Cys Ala Asp Ala Val Lys	

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gtc gat gaa aag ggc aac cac gtt ttc atc gaa atg aac cca cgt atc Val Asp Glu Lys Gly Asn His Val Phe Ile Glu Met Asn Pro Arg Ile 305	310	315	960
cag gtt gag cac acc gtg act gaa gaa gtc acc gag gtg gac ctg gtg Gln Val Glu His Thr Val Thr Glu Val Thr Glu Val Asp Leu Val 325	330	335	1008
aag gcg cag atg cgc ttg gct ggt gca acc ttg aag gaa ttg ggt Lys Ala Gln Met Arg Leu Ala Ala Gly Ala Thr Leu Lys Glu Leu Gly 340	345	350	1056
ctg acc caa gat aag atc aag acc cac ggt gca gca ctg cag tgc cgc Leu Thr Gln Asp Lys Ile Lys Thr His Gly Ala Ala Leu Gln Cys Arg 355	360	365	1104
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atc acc gcg tac cgc tca cca ggc gga gct ggc gtt cgt ctt gac ggt Ile Thr Ala Tyr Arg Ser Pro Gly Gly Ala Gly Val Arg Leu Asp Gly 385	390	395	1200
gca gct cag ctc ggt ggc gaa atc acc gca cac ttt gac tcc atg ctg Ala Ala Gln Leu Gly Gly Glu Ile Thr Ala His Phe Asp Ser Met Leu 405	410	415	1248
gtg aaa atg acc tgc cgt ggt tcc gac ttt gaa act gct gtt gct cgt Val Lys Met Thr Cys Arg Gly Ser Asp Phe Glu Thr Ala Val Ala Arg 420	425	430	1296
gca cag cgc gcg ttg gct gag ttc acc gtg tct ggt gtt gca acc aac Ala Gln Arg Ala Leu Ala Glu Phe Thr Val Ser Gly Val Ala Thr Asn 435	440	445	1344
att ggt ttc ttg cgt gcg ttg ctg cgg gaa gag gac ttc act tcc aag Ile Gly Phe Leu Arg Ala Leu Leu Arg Glu Glu Asp Phe Thr Ser Lys 450	455	460	1392
cgc atc gcc acc gga ttt atc ggc gat cac cca cac ctc ctt cag gct Arg Ile Ala Thr Gly Phe Ile Gly Asp His Pro His Leu Leu Gln Ala 465	470	475	1440
cca cct gcg gat gat gag cag gga cgc atc ctg gat tac ttg gca gat Pro Pro Ala Asp Asp Glu Gln Gly Arg Ile Leu Asp Tyr Leu Ala Asp 485	490	495	1488
gtc acc gtg aac aag cct cat ggt gtg cgt cca aag gat gtt gca gca Val Thr Val Asn Lys Pro His Gly Val Arg Pro Lys Asp Val Ala Ala 500	505	510	1536
cca atc gat aag ctg ccc aac atc aag gat ctg cca ctg cca cgc ggt Pro Ile Asp Lys Leu Pro Asn Ile Lys Asp Leu Pro Leu Pro Arg Gly 515	520	525	1584

tcc cgt gac cgc ctg aag cag ctt ggc cca gcc gcg ttt gct cgt gat	1632
Ser Arg Asp Arg Leu Lys Gln Leu Gly Pro Ala Ala Phe Ala Arg Asp	
530 535 540	
ctc cgt gag cag gac gca ctg gca gtt act gat acc acc ttc cgc gat	1680
Leu Arg Glu Gln Asp Ala Leu Ala Val Thr Asp Thr Phe Arg Asp	
545 550 555 560	
gca cac cag tct ttg ctt gcg acc cga gtc cgc tca ttc gca ctg aag	1728
Ala His Gln Ser Leu Leu Ala Thr Arg Val Arg Ser Phe Ala Leu Lys	
565 570 575	
cct gcg gca gag gcc gtc gca aag ctg act cct gag ctt ttg tcc gtg	1776
Pro Ala Ala Glu Ala Val Ala Lys Leu Thr Pro Glu Leu Leu Ser Val	
580 585 590	
gag gcc tgg ggc ggc gcg acc tac gat gtg gcg atg cgt ttc ctc ttt	1824
Glu Ala Trp Gly Gly Ala Thr Tyr Asp Val Ala Met Arg Phe Leu Phe	
595 600 605	
gag gat ccg tgg gac agg ctc gac gag ctg cgc gag gcg atg ccg aat	1872
Glu Asp Pro Trp Asp Arg Leu Asp Glu Leu Arg Glu Ala Met Pro Asn	
610 615 620	
gta aac att cag atg ctg ctt cgc ggc cgc aac acc gtg gga tac acc	1920
Val Asn Ile Gln Met Leu Leu Arg Gly Arg Asn Thr Val Gly Tyr Thr	
625 630 635 640	
ccg tac cca gac tcc gtc tgc cgc gcg ttt gtt aag gaa gct gcc agc	1968
Pro Tyr Pro Asp Ser Val Cys Arg Ala Phe Val Lys Glu Ala Ala Ser	
645 650 655	
tcc ggc gtg gac atc ttc cgc atc ttc gac gcg ctt aac gac gtc tcc	2016
Ser Gly Val Asp Ile Phe Arg Ile Phe Asp Ala Leu Asn Asp Val Ser	
660 665 670	
cag atg cgt cca gca atc gac gca gtc ctg gag acc aac acc gcg gta	2064
Gln Met Arg Pro Ala Ile Asp Ala Val Leu Glu Thr Asn Thr Ala Val	
675 680 685	
gcc gag gtg gct atg gct tat tct ggt gat ctc tct gat cca aat gaa	2112
Ala Glu Val Ala Met Ala Tyr Ser Gly Asp Leu Ser Asp Pro Asn Glu	
690 695 700	
aag ctc tac acc ctg gat tac tac cta aag atg gca gag gag atc gtc	2160
Lys Leu Tyr Thr Leu Asp Tyr Tyr Leu Lys Met Ala Glu Glu Ile Val	
705 710 715 720	
aag tct ggc gct cac att ctg gcc att aag gat atg gct ggt ctg ctt	2208
Lys Ser Gly Ala His Ile Leu Ala Ile Lys Asp Met Ala Gly Leu Leu	
725 730 735	
cgc cca gct gcg gta acc aag ctg gtc acc gca ctg cgc cgt gaa ttc	2256
Arg Pro Ala Ala Val Thr Lys Leu Val Thr Ala Leu Arg Arg Glu Phe	
740 745 750	
gat ctg cca gtg cac gtg cac acc cac gac act gcg ggt ggc cag ttg	2304
Asp Leu Pro Val His Val His Thr His Asp Thr Ala Gly Gly Gln Leu	
755 760 765	
gct acc tac ttt gct gca gct caa gct ggt gca gat gct gtt gac ggt	2352
Ala Thr Tyr Phe Ala Ala Ala Gln Ala Gly Ala Asp Ala Val Asp Gly	

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gag gct gtt tct gac ctc gag ccg tac tgg gaa gct gtg cgc gga ctg Glu Ala Val Ser Asp Leu Glu Pro Tyr Trp Glu Ala Val Arg Gly Leu 820 825 830			2496
tac ctg cca ttt gag tct gga acc cca ggc cca acc ggt cgc gtc tac Tyr Leu Pro Phe Glu Ser Gly Thr Pro Gly Pro Thr Gly Arg Val Tyr 835 840 845			2544
cgc cac gaa atc cca ggc gga cag ttg tcc aac ctg cgt gca cag gcc Arg His Glu Ile Pro Gly Gly Gln Leu Ser Asn Leu Arg Ala Gln Ala 850 855 860			2592
acc gca ctg ggc ctt gct gat cgc ttc gag ctc atc gaa gac aac tac Thr Ala Leu Gly Leu Ala Asp Arg Phe Glu Leu Ile Glu Asp Asn Tyr 865 870 875 880			2640
gca gcc gtt aat gag atg ctg gga cgc cca acc aag gtc acc cca tcc Ala Ala Val Asn Glu Met Leu Gly Arg Pro Thr Lys Val Thr Pro Ser 885 890 895			2688
tcc aag gtt gtt ggc gac ctc gca ctc cac ctg gtt ggt gcg ggt gta Ser Lys Val Val Gly Asp Leu Ala Leu His Leu Val Gly Ala Gly Val 900 905 910			2736
gat cca gca gac ttt gct gca gac cca caa aag tac gac atc cca gac Asp Pro Ala Asp Phe Ala Ala Asp Pro Gln Lys Tyr Asp Ile Pro Asp 915 920 925			2784
tct gtc atc gcg ttc ctg cgc ggc gag ctt ggt aac cct cca ggt ggc Ser Val Ile Ala Phe Leu Arg Gly Glu Leu Gly Asn Pro Pro Gly Gly 930 935 940			2832
tgg cca gaa cca ctg cgc acc cgc gca ctg gaa ggc cgc tcc gaa ggc Trp Pro Glu Pro Leu Arg Thr Arg Ala Leu Glu Gly Arg Ser Glu Gly 945 950 955 960			2880
aag gca cct ctg acg gaa gtt cct gag gaa gag cag gcg cac ctc gac Lys Ala Pro Leu Thr Glu Val Pro Glu Glu Gln Ala His Leu Asp 965 970 975			2928
gct gat gat tcc aag gaa cgt cgc aac agc ctc aac cgc ctg ctg ttc Ala Asp Asp Ser Lys Glu Arg Arg Asn Ser Leu Asn Arg Leu Leu Phe 980 985 990			2976
ccg aag cca acc gaa gag ttc ctc gag cac cgt cgc cgc ttc ggc aac Pro Lys Pro Thr Glu Glu Phe Leu Glu His Arg Arg Arg Phe Gly Asn 995 1000 1005			3024
acc tct gcg ctg gat gat cgt gaa ttc ttc tac gga ctg gtc gag Thr Ser Ala Leu Asp Asp Arg Glu Phe Phe Tyr Gly Leu Val Glu 1010 1015 1020			3069

ggc cgc gag act ttg atc cgc	ctg cca gat gtg cgc	acc cca ctg	3114
Gly Arg Glu Thr Leu Ile Arg	Leu Pro Asp Val Arg	Thr Pro Leu	
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ctt gtt cgc ctg gat gcg atc	tct gag cca gac gat	aag ggt atg	3159
Leu Val Arg Leu Asp Ala Ile	Ser Glu Pro Asp Asp	Lys Gly Met	
1040	1045	1050	
cgc aat gtt gtg gcc aac gtc	aac ggc cag atc cgc	cca atg cgt	3204
Arg Asn Val Val Ala Asn Val	Asn Gly Gln Ile Arg	Pro Met Arg	
1055	1060	1065	
gtg cgt gac cgc tcc gtt gag	tct gtc acc gca acc	gca gaa aag	3249
Val Arg Asp Arg Ser Val Glu	Ser Val Thr Ala Thr	Ala Glu Lys	
1070	1075	1080	
gca gat tcc tcc aac aag ggc	cat gtt gct gca cca	ttc gct ggt	3294
Ala Asp Ser Ser Asn Lys Gly	His Val Ala Ala Pro	Phe Ala Gly	
1085	1090	1095	
gtt gtc act gtg act gtt gct	gaa ggt gat gag gtc	aag gct gga	3339
Val Val Thr Val Thr Val Ala	Glu Gly Asp Glu Val	Lys Ala Gly	
1100	1105	1110	
gat gca gtc gca atc atc gag	gct atg aag atg gaa	gca aca atc	3384
Asp Ala Val Ala Ile Ile Glu	Ala Met Lys Met Glu	Ala Thr Ile	
1115	1120	1125	
act gct tct gtt gac ggc aag	att gaa cgc gtt gtg	gtt cct gct	3429
Thr Ala Ser Val Asp Gly Lys	Ile Glu Arg Val Val	Val Pro Ala	
1130	1135	1140	
gca acg aag gtg gaa ggt ggc	gac ttg atc gtc gtc	gtt tcc taa	3474
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<211> 1157

<212> PRT

<213> Corynebacterium glutamicum

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Leu Val Ala Asn Arg Gly Glu Ile Ala Val Arg Ala Phe Arg Ala Ala
35 40 45

Leu Glu Thr Gly Ala Ala Thr Val Ala Ile Tyr Pro Arg Glu Asp Arg

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Gly Ser Phe His Arg Ser Phe Ala Ser Glu Ala Val Arg Ile Gly Thr		
65	70	75
80		
Glu Gly Ser Pro Val Lys Ala Tyr Leu Asp Ile Asp Glu Ile Ile Gly		
85	90	95
Ala Ala Lys Lys Val Lys Ala Asp Ala Ile Tyr Pro Gly Tyr Gly Phe		
100	105	110
Leu Ser Glu Asn Ala Gln Leu Ala Arg Glu Cys Ala Glu Asn Gly Ile		
115	120	125
Thr Phe Ile Gly Pro Thr Pro Glu Val Leu Asp Leu Thr Gly Asp Lys		
130	135	140
Ser Arg Ala Val Thr Ala Ala Lys Lys Ala Gly Leu Pro Val Leu Ala		
145	150	155
160		
Glu Ser Thr Pro Ser Lys Asn Ile Asp Asp Ile Val Lys Ser Ala Glu		
165	170	175
Gly Gln Thr Tyr Pro Ile Phe Val Lys Ala Val Ala Gly Gly Gly		
180	185	190
Arg Gly Met Arg Phe Val Ser Ser Pro Asp Glu Leu Arg Lys Leu Ala		
195	200	205
Thr Glu Ala Ser Arg Glu Ala Glu Ala Ala Phe Gly Asp Gly Ser Val		
210	215	220
Tyr Val Glu Arg Ala Val Ile Asn Pro Gln His Ile Glu Val Gln Ile		
225	230	235
240		
Leu Gly Asp Arg Thr Gly Glu Val Val His Leu Tyr Glu Arg Asp Cys		
245	250	255
Ser Leu Gln Arg Arg His Gln Lys Val Val Glu Ile Ala Pro Ala Gln		
260	265	270
His Leu Asp Pro Glu Leu Arg Asp Arg Ile Cys Ala Asp Ala Val Lys		
275	280	285
Phe Cys Arg Ser Ile Gly Tyr Gln Gly Ala Gly Thr Val Glu Phe Leu		
290	295	300

Val Asp Glu Lys Gly Asn His Val Phe Ile Glu Met Asn Pro Arg Ile
305 310 315 320

Gln Val Glu His Thr Val Thr Glu Glu Val Thr Glu Val Asp Leu Val
325 330 335

Lys Ala Gln Met Arg Leu Ala Ala Gly Ala Thr Leu Lys Glu Leu Gly
340 345 350

Leu Thr Gln Asp Lys Ile Lys Thr His Gly Ala Ala Leu Gln Cys Arg
355 360 365

Ile Thr Thr Glu Asp Pro Asn Asn Gly Phe Arg Pro Asp Thr Gly Thr
370 375 380

Ile Thr Ala Tyr Arg Ser Pro Gly Gly Ala Gly Val Arg Leu Asp Gly
385 390 395 400

Ala Ala Gln Leu Gly Gly Glu Ile Thr Ala His Phe Asp Ser Met Leu
405 410 415

Val Lys Met Thr Cys Arg Gly Ser Asp Phe Glu Thr Ala Val Ala Arg
420 425 430

Ala Gln Arg Ala Leu Ala Glu Phe Thr Val Ser Gly Val Ala Thr Asn
435 440 445

Ile Gly Phe Leu Arg Ala Leu Leu Arg Glu Glu Asp Phe Thr Ser Lys
450 455 460

Arg Ile Ala Thr Gly Phe Ile Gly Asp His Pro His Leu Leu Gln Ala
465 470 475 480

Pro Pro Ala Asp Asp Glu Gln Gly Arg Ile Leu Asp Tyr Leu Ala Asp
485 490 495

Val Thr Val Asn Lys Pro His Gly Val Arg Pro Lys Asp Val Ala Ala
500 505 510

Pro Ile Asp Lys Leu Pro Asn Ile Lys Asp Leu Pro Leu Pro Arg Gly
515 520 525

Ser Arg Asp Arg Leu Lys Gln Leu Gly Pro Ala Ala Phe Ala Arg Asp
530 535 540

Leu Arg Glu Gln Asp Ala Leu Ala Val Thr Asp Thr Thr Phe Arg Asp
545 550 555 560

Ala His Gln Ser Leu Leu Ala Thr Arg Val Arg Ser Phe Ala Leu Lys
565 570 575

Pro Ala Ala Glu Ala Val Ala Lys Leu Thr Pro Glu Leu Leu Ser Val
580 585 590

Glu Ala Trp Gly Gly Ala Thr Tyr Asp Val Ala Met Arg Phe Leu Phe
595 600 605

Glu Asp Pro Trp Asp Arg Leu Asp Glu Leu Arg Glu Ala Met Pro Asn
610 615 620

Val Asn Ile Gln Met Leu Leu Arg Gly Arg Asn Thr Val Gly Tyr Thr
625 630 635 640

Pro Tyr Pro Asp Ser Val Cys Arg Ala Phe Val Lys Glu Ala Ala Ser
645 650 655

Ser Gly Val Asp Ile Phe Arg Ile Phe Asp Ala Leu Asn Asp Val Ser
660 665 670

Gln Met Arg Pro Ala Ile Asp Ala Val Leu Glu Thr Asn Thr Ala Val
675 680 685

Ala Glu Val Ala Met Ala Tyr Ser Gly Asp Leu Ser Asp Pro Asn Glu
690 695 700

Lys Leu Tyr Thr Leu Asp Tyr Tyr Leu Lys Met Ala Glu Glu Ile Val
705 710 715 720

Lys Ser Gly Ala His Ile Leu Ala Ile Lys Asp Met Ala Gly Leu Leu
725 730 735

Arg Pro Ala Ala Val Thr Lys Leu Val Thr Ala Leu Arg Arg Glu Phe
740 745 750

Asp Leu Pro Val His Val His Thr His Asp Thr Ala Gly Gly Gln Leu
755 760 765

Ala Thr Tyr Phe Ala Ala Ala Gln Ala Gly Ala Asp Ala Val Asp Gly
770 775 780

Ala Ser Ala Pro Leu Ser Gly Thr Thr Ser Gln Pro Ser Leu Ser Ala
785 790 795 800

Ile Val Ala Ala Phe Ala His Thr Arg Arg Asp Thr Gly Leu Ser Leu

805

810

815

Glu Ala Val Ser Asp Leu Glu Pro Tyr Trp Glu Ala Val Arg Gly Leu
820 825 830

Tyr Leu Pro Phe Glu Ser Gly Thr Pro Gly Pro Thr Gly Arg Val Tyr
835 840 845

Arg His Glu Ile Pro Gly Gly Gln Leu Ser Asn Leu Arg Ala Gln Ala
850 855 860

Thr Ala Leu Gly Leu Ala Asp Arg Phe Glu Leu Ile Glu Asp Asn Tyr
865 870 875 880

Ala Ala Val Asn Glu Met Leu Gly Arg Pro Thr Lys Val Thr Pro Ser
885 890 895

Ser Lys Val Val Gly Asp Leu Ala Leu His Leu Val Gly Ala Gly Val
900 905 910

Asp Pro Ala Asp Phe Ala Ala Asp Pro Gln Lys Tyr Asp Ile Pro Asp
915 920 925

Ser Val Ile Ala Phe Leu Arg Gly Glu Leu Gly Asn Pro Pro Gly Gly
930 935 940

Trp Pro Glu Pro Leu Arg Thr Arg Ala Leu Glu Gly Arg Ser Glu Gly
945 950 955 960

Lys Ala Pro Leu Thr Glu Val Pro Glu Glu Glu Gln Ala His Leu Asp
965 970 975

Ala Asp Asp Ser Lys Glu Arg Arg Asn Ser Leu Asn Arg Leu Leu Phe
980 985 990

Pro Lys Pro Thr Glu Glu Phe Leu Glu His Arg Arg Arg Phe Gly Asn
995 1000 1005

Thr Ser Ala Leu Asp Asp Arg Glu Phe Phe Tyr Gly Leu Val Glu
1010 1015 1020

Gly Arg Glu Thr Leu Ile Arg Leu Pro Asp Val Arg Thr Pro Leu
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1070 1075 1080

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Val Val Thr Val Thr Val Ala Glu Gly Asp Glu Val Lys Ala Gly
1100 1105 1110

Asp Ala Val Ala Ile Ile Glu Ala Met Lys Met Glu Ala Thr Ile
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<212> DNA

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35 40 45

Ser Phe His Arg Ser Phe Ala Ser Glu Ala Val Arg Ile Gly Thr Glu
50 55 60

Gly Ser Pro Val Lys Ala Tyr Leu Asp Ile Asp Glu Ile Ile Gly Ala
65 70 75 80

Ala Lys Lys Val Lys Ala Asp Ala Ile Tyr Pro Gly Tyr Gly Phe Leu
85 90 95

Ser Glu Asn Ala Gln Leu Ala Arg Glu Cys Ala Glu Asn Gly Ile Thr
100 105 110

Phe Ile Gly Pro Thr Pro Glu Val Leu Asp Leu Thr Gly Asp Lys Ser
115 120 125

Arg Ala Val Thr Ala Ala Lys Lys Ala Gly Leu Pro Val Leu Ala Glu
130 135 140

Ser Thr Pro Ser Lys Asn Ile Asp Glu Ile Val Lys Ser Ala Glu Gly
145 150 155 160

Gln Thr Tyr Pro Ile Phe Val Lys Ala Val Ala Gly Gly Gly Arg
165 170 175

Gly Met Arg Phe Val Ala Ser Pro Asp Glu Leu Arg Lys Leu Ala Thr
180 185 190

Glu Ala Ser Arg Glu Ala Glu Ala Phe Gly Asp Gly Ala Val Tyr
195 200 205

Val Glu Arg Ala Val Ile Asn Pro Gln His Ile Glu Val Gln Ile Leu
210 215 220

Gly Asp His Thr Gly Glu Val Val His Leu Tyr Glu Arg Asp Cys Ser
225 230 235 240

Leu Gln Arg Arg His Gln Lys Val Val Glu Ile Ala Pro Ala Gln His
245 250 255

Leu Asp Pro Glu Leu Arg Asp Arg Ile Cys Ala Asp Ala Val Lys Phe
260 265 270

Cys Arg Ser Ile Gly Tyr Gln Gly Ala Gly Thr Val Glu Phe Leu Val
275 280 285

Asp Glu Lys Gly Asn His Val Phe Ile Glu Met Asn Pro Arg Ile Gln
290 295 300

Val Glu His Thr Val Thr Glu Glu Val Thr Glu Val Asp Leu Val Lys
305 310 315 320

Ala Gln Met Arg Leu Ala Ala Gly Ala Thr Leu Lys Glu Leu Gly Leu
325 330 335

Thr Gln Asp Lys Ile Lys Thr His Gly Ala Ala Leu Gln Cys Arg Ile
340 345 350

Thr Thr Glu Asp Pro Asn Asn Gly Phe Arg Pro Asp Thr Gly Thr Ile
355 360 365

Thr Ala Tyr Arg Ser Pro Gly Gly Ala Gly Val Arg Leu Asp Gly Ala
370 375 380

Ala Gln Leu Gly Gly Glu Ile Thr Ala His Phe Asp Ser Met Leu Val
385 390 395 400

Lys Met Thr Cys Arg Gly Ser Asp Phe Glu Thr Ala Val Ala Arg Ala
405 410 415

Gln Arg Ala Leu Ala Glu Phe Thr Val Ser Gly Val Ala Thr Asn Ile
420 425 430

Gly Phe Leu Arg Ala Leu Leu Arg Glu Glu Asp Phe Thr Ser Lys Arg
435 440 445

Ile Ala Thr Gly Phe Ile Ala Asp His Pro His Leu Leu Gln Ala Pro
450 455 460

Pro Ala Asp Asp Glu Gln Gly Arg Ile Leu Asp Tyr Leu Ala Asp Val
465 470 475 480

Thr Val Asn Lys Pro His Gly Val Arg Pro Lys Asp Val Ala Ala Pro
485 490 495

Ile Asp Lys Leu Pro Asn Ile Lys Asp Leu Pro Leu Pro Arg Gly Ser
500 505 510

Arg Asp Arg Leu Lys Gln Leu Gly Pro Ala Ala Phe Ala Arg Asp Leu
515 520 525

Arg Glu Gln Asp Ala Leu Ala Val Thr Asp Thr Thr Phe Arg Asp Ala
530 535 540

His Gln Ser Leu Leu Ala Thr Arg Val Arg Ser Phe Ala Leu Lys Pro
545 550 555 560

Ala Ala Glu Ala Val Ala Lys Leu Thr Pro Glu Leu Leu Ser Val Glu
565 570 575

Ala Trp Gly Gly Ala Thr Tyr Asp Val Ala Met Arg Phe Leu Phe Glu
580 585 590

Asp Pro Trp Asp Arg Leu Asp Glu Leu Arg Glu Ala Met Pro Asn Val
595 600 605

Asn Ile Gln Met Leu Leu Arg Gly Arg Asn Thr Val Gly Tyr Thr Pro
610 615 620

Tyr Pro Asp Ser Val Cys Arg Ala Phe Val Lys Glu Ala Ala Ser Ser
625 630 635 640

Gly Val Asp Ile Phe Arg Ile Phe Asp Ala Leu Asn Asp Val Ser Gln
645 650 655

Met Arg Pro Ala Ile Asp Ala Val Leu Glu Thr Asn Thr Ala Val Ala
660 665 670

Glu Val Ala Met Ala Tyr Ser Gly Asp Leu Ser Asp Pro Asn Glu Lys
675 680 685

Leu Tyr Thr Leu Asp Tyr Tyr Leu Lys Met Ala Glu Glu Ile Val Lys
690 695 700

Ser Gly Ala His Ile Leu Ala Ile Lys Asp Met Ala Gly Leu Leu Arg
705 710 715 720

Pro Ala Ala Val Thr Lys Leu Val Thr Ala Leu Arg Arg Glu Phe Asp
725 730 735

Leu Pro Val His Val His Thr His Asp Thr Ala Gly Gly Gln Leu Ala
740 745 750

Thr Tyr Phe Ala Ala Ala Gln Ala Gly Ala Asp Ala Val Asp Gly Ala
755 760 765

Ser Ala Pro Leu Ser Gly Thr Thr Ser Gln Pro Ser Leu Ser Ala Ile
770 775 780

Val Ala Ala Phe Ala His Thr Arg Arg Asp Thr Gly Leu Ser Leu Glu
785 790 795 800

Ala Val Ser Asp Leu Glu Pro Tyr Trp Glu Ala Val Arg Gly Leu Tyr
805 810 815

Leu Pro Phe Glu Ser Gly Thr Pro Gly Pro Thr Gly Arg Val Tyr Arg
820 825 830

His Glu Ile Pro Gly Gly Gln Leu Ser Asn Leu Arg Ala Gln Ala Thr
835 840 845

Ala Leu Gly Leu Ala Asp Arg Phe Glu Leu Ile Glu Asp Asn Tyr Ala
850 855 860

Ala Val Asn Glu Met Leu Gly Arg Pro Thr Lys Val Thr Pro Ser Ser
865 870 875 880

Lys Val Val Gly Asp Leu Ala Leu His Leu Val Gly Ala Gly Val Asp
885 890 895

Pro Ala Asp Phe Ala Ala Asp Pro Gln Lys Tyr Asp Ile Pro Asp Ser
900 905 910

Val Ile Ala Phe Leu Arg Gly Glu Leu Gly Asn Pro Pro Gly Gly Trp
915 920 925

Pro Glu Pro Leu Arg Thr Arg Ala Leu Glu Gly Arg Ser Glu Gly Lys
930 935 940

Ala Pro Leu Thr Glu Val Pro Glu Glu Glu Gln Ala His Leu Asp Ala
945 950 955 960

Asp Asp Ser Lys Glu Arg Arg Asn Ser Leu Asn Arg Leu Leu Phe Pro
965 970 975

Lys Pro Thr Glu Glu Phe Leu Glu His Arg Arg Arg Phe Gly Asn Thr
980 985 990

Ser Ala Leu Asp Asp Arg Glu Phe Phe Tyr Gly Leu Val Glu Gly Arg
995 1000 1005

Glu Thr Leu Ile Arg Leu Pro Asp Val Arg Thr Pro Leu Leu Val
1010 1015 1020

Arg Leu Asp Ala Ile Ser Glu Pro Asp Asp Lys Gly Met Arg Asn
1025 1030 1035

Val Val Ala Asn Val Asn Gly Gln Ile Arg Pro Met Arg Val Arg
1040 1045 1050

Asp Arg Ser Val Glu Ser Val Thr Ala Thr Ala Glu Lys Ala Asp
1055 1060 1065

Ser Ser Asn Lys Gly His Val Ala Ala Pro Phe Ala Gly Val Val
1070 1075 1080

B15
Thr Val Thr Val Ala Glu Gly Asp Glu Val Lys Ala Gly Asp Ala
1085 1090 1095

Val Ala Ile Ile Glu Ala Met Lys Met Glu Ala Thr Ile Thr Ala
1100 1105 1110

Ser Val Asp Gly Lys Ile Asp Arg Val Val Val Pro Ala Ala Thr
1115 1120 1125

Lys Val Glu Gly Gly Asp Leu Ile Val Val Val Ser
1130 1135 1140